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ABSTRACT

Students at first, fourth, seventh, and tenth grade levels and at graduate levels chose conjunctions "and" and "but" in two-clause sentences with varying degrees of logical relationship, with similar or contrasting clauses. Grade, type of relationship, and similarity were variables in a 5 x 3 x 2 repeated measures analysis of response to logical and syntactic features of sentences. Significant effects were found for grade, type, similarity, and their interactions. Children increasingly chose conjunctions on the basis of clause similarity or dissimilarity. Older subjects, however, appeared to use this simple rule only if a logical relationship existed between clauses. The resulting U-shaped function for unrelated sentences is discussed as cognitively based rule differentiation. (Author)

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DEVELOPMENTAL STUDY OF FACTORS INVOLVED IN CHOICE OF CONJUNCTIONS

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Students at 1st, 4th, 7th and 10th grades and adult levels chose conjunctions and and but in two-clause sentences with varying degrees of logical relationship, with similar or contrasting clauses. Grade, Type of relationship, and Similarity were variables in a 5 x 3 x 2 repeated measures analysis of response to logical and syntactic features of sentences.

Significant effects were found for Grade, Type, Similarity and their interactions. Children increasingly chose conjunctions on the basis of clause similarity or dissimilarity. Older subjects, however, appeared to use this simple rule only if a logical relationship existed between clauses. The resulting U-shaped function for unrelated sentences is discussed as cognitively based rule differentiation.

DEVELOPMENTAL STUDY OF FACTORS INVOLVED IN THE CHOICE OF CONJUNCTIONS

The many investigations of children's grammar during the past decade have stimulated renewed interest in the relationship of language and cognition (Olson, 1970; Hayes, 1970). Bever (1970) comments that "the influences of language and cognition are mutual; one cannot consider one without the other." Sachs (1971) suggests, "Theories of language acquisition that consider only the linguistic aspect will not be able to explain why the child learns new forms when he does, or in fact why he ever changes his form of expression."

In both language and logic, concepts of conjunction show major development after school entrance. Conjunctions appear in children's language by age 3 or 4 (Miller, 1973). However, mature, consistently appropriate use of conjunction would seem to require logical coordination of two or more terms, a skill that matures during the elementary school years (Inhelder and Piaget, 1964).

In both language and logic, conjunction is more difficult when it involves negation. In studying logical coordination, Neimark and Slotnick (1972) indicated that subjects find it easier to choose an object that is "round" and "red" (a conjunctive concept) than to choose one that is "round" and "not red."

Similarly, the conjunction "and" appears earlier and is more accurately used at all ages tested (Katz and Brent, 1968) than is the conjunction "but," which implies dysjunction of clauses. Menyuk (1972) notes that the child entering kindergarten "produces conjoined sentences that express logical relationships, but he comprehends and uses sentences which do not place many restrictions on conjoined elements," sentences employing "and." He seldom uses or fully comprehends antithetical relationships, those contrasts which are signalled by the conjunction "but."

The parallels between development of conjunction in these two systems suggest that analysis of the relationship of language and logical aspects of conjunction might be revealing. The analysis of cognitive and linguistic aspects within a single task has been used fruitfully by Sinclair-de-Zwart (1969) to study the relationship of linguistic and logical aspects of conservation. Donaldson and Wales (1970) used this approach to study relational terms and concepts, concluding that the apparent convergence of the language performance and other cognitive performance reflects "an interaction of the two systems of competence."

One means of studying the interplay of linguistic and logical factors in conjunction within a single task is to vary the logical relationship between the clauses. It would be expected that syntactic coordination would be more difficult for sentences in which logical coordination is more complex, especially during the period in which children are developing the concept of logical coordination.

In addition to its interest from the standpoint of cognitive development, such an approach is relevant to a current issue in linguistics. Lakoff's (1971) description of the usual rule for conjunction of clauses may be summarized as:

> Sentence clauses seen as similar are likely to be joined by means of "and;" clauses seen as dissimilar are joined by means of "but."

Gleitman (1965), however, has stated that "and" can be used not only to denote similarity of clauses, but also to string together clauses as unrelated as "My grandmother grows beans and ten men can fit in a phone booth." Lakoff, scaling sentences in terms of grammatical acceptability would consider this sentence unacceptable.

Linguists often call upon their own intuition to settle such disputed points. An alternative more widely favored by psychologists is to examine the responses of a group of supposedly competent subjects, in order to determine the mature form of the response which children are developing. While the possible discrepancy between performance and competence is recognized, a task which presents minimal difficulty from performance factors should yield a reasonable estimate of competence.

The central purpose of this study was to examine factors influencing choice of the conjunction "and" or "but" in joining the two clauses of a compoind sentence. This simple response is of interest because it seems to reflect the cognitive process of sensing and marking similarity or dissimilarity of the two propositions joined. Judging this similarity may in some sentences require coordination of a two- or three-term logical relationship as well as logical coordination of this information with syntactic concepts.

In order to study the effects of various kinds of within-sentence relationships, three sentence types were formed, with each type presented as either similar or contrasting clauses.

1a Identical = Mr. Green is rich __ his son is rich.

1b Identical ≠ Mr. Green is rich __ his son is poor.

2a Related = Mr. Green is rich __ he has a shiny new car.

2b Related ≠ Mr. Green is rich __ he has a rusty old car.

3a Unrelated = Mr. Green is rich __ he is tall.

3b Unrelated ≠ Mr. Green is rich __ he is short.

Sentences termed Identical are those in which the dimension of the topics is identical. For example, in sentence 1a both subjects have

similar positions on the dimension "richness;" in sentence 1b the same dimension is employed, but the subjects differ in their position on this dimension. If "rich" is high on the dimension of wealth, "poor" is low on the same dimension.

Sentences termed Related have a less overtly stated relationship, but one that can be understood by a listener who shares in the cultural presuppositions about the relationship of two dimensions or characteristics. He must coordinate this knowledge with the propositions contained in the sentence in order to understand the relationship of the conjuncts. For example, in sentence 2a the two clauses of the sentences are related through the unstated presupposition that being rich enables one to buy a shiny new car; in sentence 2b the expected relationship is violated -- although the man is rich, he has an old car. Ability to coordinate the propositions of Related sentences would be expected to show strong developmental trends.

Sentences termed Unrelated are those in which there is no necessary or logical relationship between the two clauses. In such a situation, however, connotative features of the sentences may determine whether the clauses are seen as similar or dissimilar (Gumenik and Dolinsky, 1969). In sentence 3a the clauses are not logically related, but both richness and tallness are both generally considered positive attributes. A contrast may be seen in sentence 3b between the positive attribute, richness, and the negative attribute, shortness. The subjective nature of connotative judgments suggests that there would be less agreement on sentences of this type than on other types, and that even adults might be less consistent in application of the rule for conjunction in such sentences.

There were, in summary, 3 sentence types, each presented with either similar or contrasting clauses. Subjects were asked to choose "and" or "but" as the conjunction. In order to explore developmental trends over a broad span, subjects were obtained from 1st, 4th, 7th, and 10th grades and from an adult sample of graduate students who represented the mature competence toward which children presumably develop.

It was expected that (1) responses to Identical sentences would deviate least from the simple rule for conjunctions and Unrelated sentences would deviate most; (2) there would be fewer deviations for sentences with similar clauses than for sentences with contrasting clauses; (3) there would be an effect for the interaction of Type and Similarity, with the greatest number of deviations in Unrelated sentences with contrasting clauses; (4) an effect for Grade, with responses of the oldest subjects most nearly converging with responses predicted by an unqualified rule that similarity of clauses is signaled by "and," contrast is signaled by "but." The possibility of developmental trends was further specified in the expectation of interactions of Grade by Type on the assumption that by fourth grade, increasing skill in handling logical relations would be manifested in Related sentences. The interactions of Grade by Similarity and Grade by Type by Similarity were examined, though no clear expectations were held.

Method:

Materials: Subjects were randomly assigned to either Form I or Form II, each of which contained 18 sentences in which subjects were to select "and" or "but" as the conjunction. There were six first clauses, each of which appeared once in an Identical dimension sentence, once as

a Related sentence and once as an Unrelated sentence. Order of sentence types of both forms was randomly determined. The order of the similar and contrasting sentences was also randomly determined on Form 1 (See Table I). A sentence presented with a similar clause on Form I appeared with a contrasting clause on Form II.

Directions: Subjects were told, "Choose the word that you think fits best in that sentence. Circle and or but." First graders were tested individually, with the tester reading the sentences (repeating them if necessary) and noting the child's choice of conjunctions. All other subjects were tested in groups, reading the sentences silently and circling the chosen conjunction.

Scoring: Responses were scored as deviations if they disagreed with the unqualified rule that conjunctions (clauses which could serve as complete simple sentences) which are similar will be joined by "and," and contrasting conjuncts will be joined by "but." This is not to imply that another choice is necessarily wrong, but provides a means of testing the degree to which the factors such as the type of relationship expressed and age of the listener modify the application of this general rule.

Subjects: From the schools of Schenectady, New York, an elementary school, junior high and high school were selected as representing a relatively continuous stream of students from lower middle- to middle-class

backgrounds. In 1st, 4th, and 7th grades one class was tested at each grade level. Because the high school was homogeneously grouped, high middle and low sections of the 10th grade were tested. A graduate class in research design, comprised mainly of students in educational psychology, secondary education and curriculum, provided the adult sample. At each grade level, 25 subjects were randomly selected.

Design: Responses of 125 subjects (25 at each grade level) were analyzed in a 5 x 3 x 2 factorial design (Grade, Type, and Similarity) with repeated measures on Type (3) and Similarity (2). Subjects were nested within Grade, but crossed Type and Similarity. A .05 level of significance was required in the main analysis, which was evaluated both by the usual F and by Greenhouse and Geisser's (1959) conservative F procedure. Tukey's procedure was used for testing means involved in significant main effects and interactions.

Results:

Before proceeding with the main analysis, differences [illegible]he total scores for Form I and II and for males and females were tested at each grade level. These differences were not significant, and the responses were combined for the remaining analyses. Significant effects were found for Grade ($p < .001$), Type ($p < .001$), Similarity ($p < .001$), Grade x Type ($p < .001$), Grade x Similarity ($p < .005$), and Grade x Type x Similarity ($p < .001$)(See Table II). In this analysis, significance levels found for the usual F procedure and for the conservative F procedure (Greenhouse and Geisser, 1959) were the same.

Grade: Deviations in choice of conjunction generally decreased over the grade levels tested, although responses of 7th graders were

more often consistent with the simple rule than were 10th graders.

Type: The Unrelated sentences were least often answered as the rule would predict. Fewest deviations, however, were observed, not in the Identical sentences, but in the Related sentences.

Similarity: Sentences with similar conjuncts were almost always answered in accordance with the general rule, but responses to sentences with contrasting clauses quite often deviated from the rule.

Grade by Type: There was considerable overlap in the 15 means, but some general patterns are apparent. First graders showed no significant differences between the three sentence types, but were most accurate on Identical sentences. For older subjects, responses to Related sentences are more accurate, followed by Identical sentences, with Unrelated sentences clearly less accurate. For 4th and 7th grade the rankings are similar but not significant. For 10th graders and graduate students the difference between Related and Unrelated sentences is significant.

Grade by Similarity: For the similar clause sentences, there was increasing consonance with the simple rule from first grade through graduate school, with the exception of the reversal in order of seventh and tenth grades. For similar sentences, graduate students were not significantly different from tenth graders, seventh graders were not significantly different from tenth graders, fourth grade and first grade were each significantly different from all other grades.

For sentences containing contrasting clauses, the pattern is more complex. Seventh graders were significantly more consistent with the simple rule than were other grades, followed by graduate students and fourth grade, which were not significantly different in the number of deviations on contrasting clause sentences. Responses of tenth graders

showed more deviations from the rule and were significantly different from those of other grades. First graders were least consistent with the rule, and the mean of deviations was significantly different from the means of all other grades.

Type by Similarity: For sentences containing Similar clauses, responses conformed most often to the simple rule on Identical sentences and least on Unrelated sentences. In contrasting clause sentences, subjects followed the simple rule most frequently on Related sentences and least on Unrelated sentences.

[Insert Figure 1 about here]

Grade by Type by Similarity: In sentences with similar clauses, accurate application of the rule for conjunction increases with age across all types of sentences employed. This developmental pattern is also found in contrasting clause sentences for Identical and Related sentences, with increasing accuracy through the seventh grade and a slight decrease at tenth grade.

For Unrelated sentences with contrasting clauses, the pattern is quite different. Responses to contrasting Unrelated sentences appear to have a curvilinear relationship with age -- deviations from the simple rule are numerous at first grade, decrease at fourth grade, and then increase steadily from seventh grade to adulthood. (The possibility that "errors" by older subjects reflect a more sophisticated rule is discussed in the next section.)

Discussion:

It should be emphasized that conjunctions were scored in terms of agreement with the simple rule "Clauses which have a similar position

on a dimension are joined with "and;" clauses which have contrasting positions on a dimension are joined with "but." A deviation, then, may reflect either a more mature or a less mature response. The results suggest a developmental trend from a largely random response, to a convergence with the simple rule, and then a new divergence toward a more complex rule.

As anticipated, the effect of the syntactic factor, Similarity, was significant -- fewer deviations of the simple rule were made on sentences with similar clauses, which call for the conjunction "and," than on sentences with contrasting clauses, which call for the conjunction "but."

Type of logical relationship was also important in determining responses to sentences. Responses to Related sentences most closely followed the simple rule for conjunctions, with Identical sentences next, responses to Unrelated sentences diverging most noticeably.

The interaction of Type and Similarity reveals some interesting differences between sentence types, especially in the contrast condition. There were deviations on almost 1/3 of the Identical sentences with Contrasting clauses, such as "Mr. Green is rich ___ his son is poor." This was a surprising finding, since Identical sentences were expected to be easiest in both similarity conditions. It may be that the contrast in Identical sentences is so obvious and so explicitly marked by the lexical items "rich" and "poor" that use of a conjunction to mark the contrast is felt to be redundant.

The increase in deviations on Identical sentences at tenth grade may be either a sampling error or, a transitional phase of over-generalizing the recently acquired rule excluding Unrelated sentences from the classes covered by the simple rule for conjunctions, just as young children

overgeneralize the plural rule to apply to irregular plurals they had previously used correctly. It is not unlikely that this same process of overextension and refinement operates later in life on more complex linguistic concepts, but we have no direct evidence.

Contrast in Related sentences such as "Mr. Green is rich ___ he drives a rusty old car" is less overt than in Identical sentences, and may require more explicit marking. Responses to Contrasting Related sentences showed a general decrease in deviations with age.

In connotatively Similar-clause Unrelated sentences such as "Mr. Green is rich ___ he is tall," adults chose "and" in 96% of their responses, and "but" only 4% of the time. For connotatively contrasting sentences such as "Mr. Green is rich ___ he is short," 65% of the responses were "and," and 35% were "but." The more mature subjects then, show some tendency to signal contrast by the conjunction "but" in connotatively contrasting but logically unrelated sentences. (It is obviously possible for subjects to <u>form</u> a logical relationship between supposedly unrelated propositions, either by idiosyncratic past experiences or by adding further stipulations to the propositions supplied by the examiner.) More often, however, they string together the two conjuncts with "and," thus deviating from the simple rule and following Gleitman's more permissive formulation.

Inspection of the pattern of responses (Figure 1) suggests two very different sources of deviations from the rule. For contrasting Unrelated sentences, deviations from the simple rule at first decrease and then steadily <u>increase</u> from seventh grade through childhood. Although re-

sponses to Related and Unrelated sentences are at first undifferentiated, somewhere between fourth and seventh grades differentiation begins. The most probable basis for this differentiation is the consideration of whether there is a logical basis for the relationship of the two clauses.

The response of more mature subjects seems to be based on an ability to differentiate sets of clauses which are unrelated from clauses which are contrasted on a logical basis. Though we do not at present have evidence for this point, it may be that mature subjects employ stress, pitch and timing rather than conjunctions to signal contrast between logically unrelated clauses. They may simply exclude connotatively contrasting sentences from the class of sentences which require the conjunction "but," and string them together as Gleitman suggests related sentences may be, with "and." The amended rule for conjunctions might read:

> If a logical relationship exists between clauses, apply the simple rule; if not, the two clauses may be joined by means of "and."

In summary, choice of the conjunctions "and" and "but" appears to be a function of the type of relationship between clauses, similarity or contrast of the clauses on a common dimension or related dimensions, and the interaction of type of relationship and similarity of clauses. In addition, each of these factors interacts significantly with age over the broad developmental scale from first grade through adulthood. Linguistic and logical aspects of a sentence, separately and in interaction, influence choice of conjunction, and their impact varies with age.

The simple linguistic choice of conjunctions "and" or "but" seems to reflect the influence of slowly maturing cognitive development. There

appears to be a trend from (I) an early, largely undifferentiated stage during which "and" predominates as the choice in all sentence types to (II) increasingly accurate application of the simple rule, and finally to (III) a mature stage in which the simple rule is applied to Identical and Related sentences but not to Unrelated sentences. Lakoff's formulation of the simple rule for conjunction appears to be generally accurate, but in need of qualification.

Implications:

If even such a simple response as this shows developmental trends over such a long period, it may be worth while to examine the full-span development of other syntactic constructions. Discovery of a long period during which various syntactic concepts reach full maturity would also encourage the search for the relationships between cognitive competence and linguistic competence. One possibility related to the present study is that of studying in the same sample both conjunction choice and logical coordination of information in a nonlinguistic context.

Another direction for future study is analysis of the means employed to express contrast in connotatively contrasting sentences in the period from fourth grade through adulthood. This might involve taping and studying aspects of voice quality. A third possibility is to study perceptions of similarity of sentences in this age range -- would Related sentences, for example, cluster with Identical sentences at some ages, and with Unrelated sentences at other ages?

More basic is the need for replication and inclusion of other grades at the apparent inflections in developmental curves. The age trends observed in the present study may serve as a guide, but require more detailed analysis.

The construction studied is specific to English, but the procedures used and the questions are surely applicable to other languages. Extending the present inquiry to other languages is potentially of great interest. By studying simple responses to carefully arranged stimuli, we may learn more about the structure of our implicit grammar, and the means by which it is formed.

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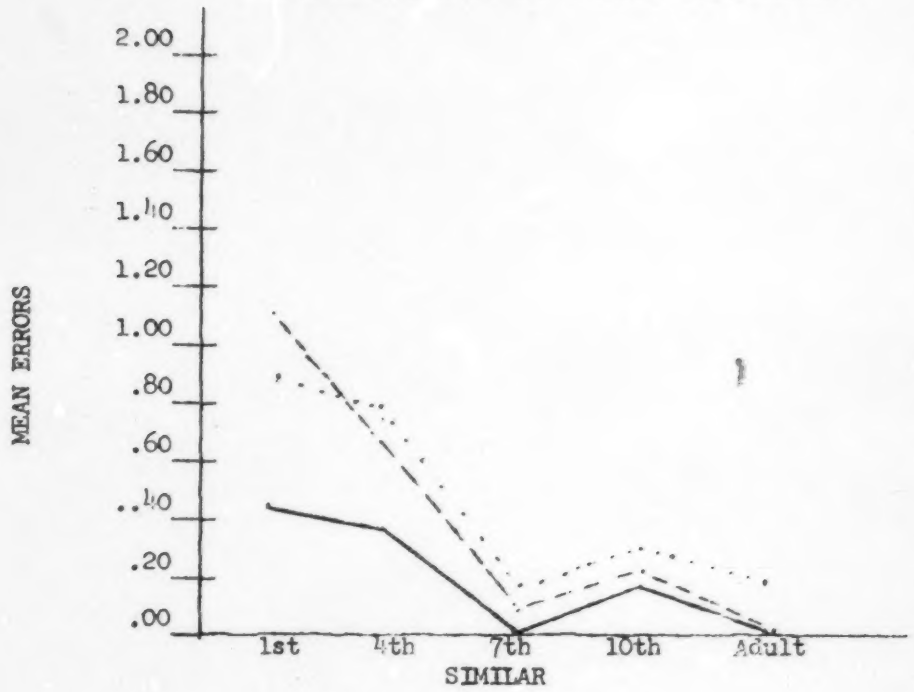
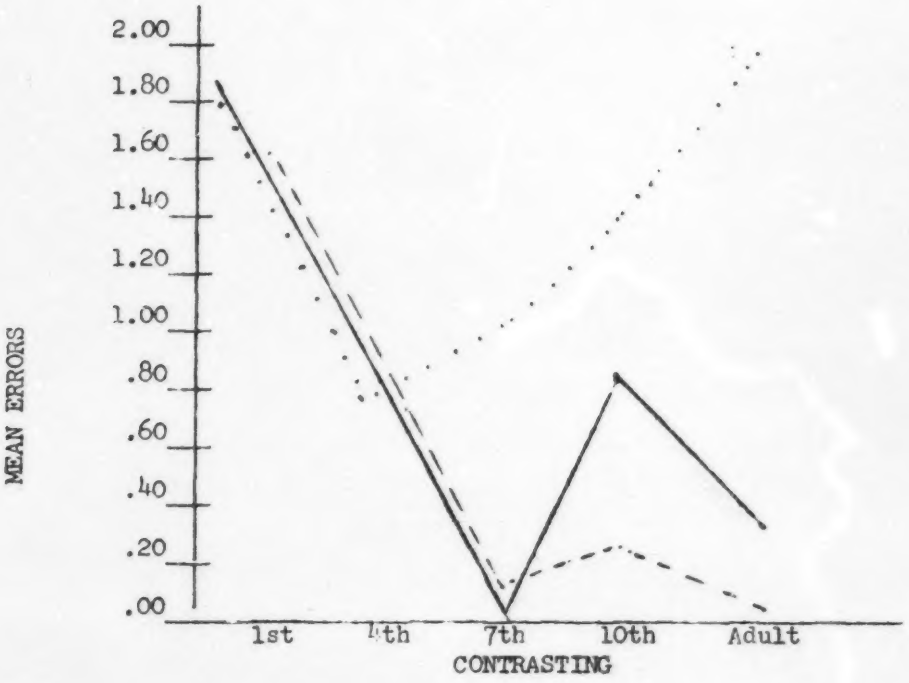
FIGURE 1

INTERACTION OF GRADE X TYPE X SIMILARITY





Key

Identical ————————
Related - - - - - - - - - -
Unrelated .....

TABLE I

SENTENCES USED IN FORM I

1. Mr. Green is rich ___ his son is rich.
2. That man looks mean ___ he helped the boy.
3. Joe is fat ___ his brother is skinny.
4. The girl is pretty ___ her bike is new.
5. Jim's face is clean ___he always brushes his hair.
6. Bob is tall ___ he can't sing well.
7. Mr. Green is rich ___ he is tall.
8. That man looks mean __ the other man looks mean.
9. Joe is fat ___ he won the race.
10. The girl is pretty ___ her dress is ugly.
11. Jim's face is clean ___ he won the race.
12. Bob is tall ___ his sister is short.
13. Mr. Green is rich ___ he has a shiny new car.
14. That man looks mean ___ his house is clean.
15. Joe is fat ___ he helps animals.
16. The girl is pretty ___ she has lots of friends.
17. Jim's face is clean ___ his hands are clean.
18. Bob is tall ___ he is not on the basketball team.

TABLE II

ANALYSIS OF VARIANCE[1]

SOURCE	df	SS	MS	F
Between	124	(170.59)		
A (Grade)	4	83.56	20.89	29.01**
A X Subjects	120	87.03	0.72	
Within	(625)	(480.50)		
B (Type)	2	35.02	17.51	51.50**
AB	8	19.84	2.48	7.29**
B X Subjects	240	82.14	0.34	
C (Similarity	1	65.12	65.12	74.00**
AC	4	14.96	3.74	4.25
C X Subjects	120	106.42	0.88	
BC	2	26.44	13.22	31.47**
ABC	8	29.26	3.65	8.69**
BC X Subjects	240	101.30	0.42	
Total	749	651.09		

*p < .05, **p < .001

[1]In this analysis, the significance levels for the usual F test and the conservative procedure (Greenhouse and Geisser, 1959) are the same.

TABLE 11

MEAN ERRORS FOR SENTENCE TYPE, SIMILARITY AND GRADE

	SIMILAR					CONTRASTING				
	Grade					Grade				
	1st	4th	7th	10th	Adult	1st	4th	7th	10th	Adult
IDENTICAL	.32	.28	.01	.16	.00	1.92	1.08	.28	.92	.32
RELATED	1.04	.68	.20	.12	.00	1.60	.52	.04	.20	.04
UNRELATED	.92	.84	.16	.28	.12	1.72	.72	1.16	1.52	1.96

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